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METHOD OF OPERATION

Routine Test of Subscribers District Selectors, Line Finder Type - Automatic Routine Selector Test Frame - Panel Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to automatically test subscriber district selector circuits which are used in connection with panel line finders. This circuit is arranged to test either one or two-party message registers, coin collect and flat rate type of district circuits.

2. WORKING LIMITS

2.1 When using this circuit, the battery voltage must be maintained at 48.5 to 50 volts for 48 volts battery and at 24 to 25 volts for 24 volt battery.

OPERATION

3. PRINCIPAL FUNCTIONS

3.1 This circuit is used to test each and every district selector circuit and consists of making a particular brush and group selection and trunk hunting for a particular set of terminals and of returning the district selector to normal upon a successful conclusion of the test. The circuit makes use of line finders which are a part of the equipment of the exchanges. These line finders are in turn selected by master and group connectors which form a part of the automatic test circuit. The principal functions of this circuit are to test for:

3.11 Idle or busy condition of district.

3.12 Proper selection of terminals by the district.

3.13 Operation and release of both supervisory relays.

3.14 Proper charging of calls.

3.15 Return to normal of district.

4. CONNECTING CIRCUITS

4.1 This test circuit will function with subscribers' district selector circuits that are used in connection with panel line finders. These district selectors may be of the one or two-party message register type or coin collect and flat rate type.

DESCRIPTION OF OPERATION

(NOTE) TWO AUTOMATIC TEST SETS IN SAME OFFICE

When two automatic district test circuits are used in the same office, the same test line code and the same group of trunks are used. The [illegible] relay of figure 3 is used with the test circuit which is associated with the test line on the third set of terminals, and the (BLK) relay of figure 4 is used with the test circuit which is associated with the test line on the fourth set of terminals. This arrangement will prevent simultaneous hunting by the district or office selector for the district test line. If the test circuit associated with test line 3 gets into the position for priming the sender before the test circuit associated with test line 4 then the (BLK) relay of figure 3 operates from a make contact on the (PC) relay. The operation of the (BLK) relay of figure 3 opens the operating path of the (BLK) relay of figure 4 preventing the test circuit associated with test line 4 from priming the sender until the district or office selector reaches the test line associated on the third set of terminals and vice versa. The (BLK) relay of figure 4 operated prevents the (BLK) relay of figure 3 from operating until the district or office selector reaches the test line connected to the fourth set of terminals. When the selector reaches the test line terminals the TC relay operates allowing the (BLK) relay to release which in turn allows the (BLK) relay of the other test circuit to operate and lock until the district selector reaches its test line.

5. START TESTS

The operation of the (ST) key, (a) advances the (R-1) switch to position 2, (b) operates the (ST) relay and (c) operates the (TA) relay if the time alarm measure switch is normal. The function of the (TA) relay is explained under "Time Measure Feature". In position 2, ground through (SS-1), (PLSF), (PMG) and (PM) relays normal, cams (I) and (J), winding of the (STP-2) relay, (STP) brush, (EC) relay normal and (STP) brush, winding of the (SM) relay, operates both the (STP-2) and (SM) relays. The (MA) and (MB) magnets operate, in a circuit from ground on cam (Q-1) through the contacts of the class relays, (FR) relay, (CA), (REP) and (PC) keys, (EC-1) and (SPT-1) relays, cam (U), (SM) relay, windings of the master magnets to battery. The primary winding of the (STP)

relay is short-circuited through the (STP-2) relay operated, cam (U) and (SM) relay and master magnets contacts to cam (T).

6. STEPS MASTER SELECTOR

When the master magnets operate, the shunt is removed from the (STP) relay, which operates. Ground on cams (L-3) and (K-3) through the (SLFT) relay, (PC) key, (SPT), (STP) and (DTS) relays normal to cam (B), advances the (R-1) switch to position 3. As the switch leaves position 2, the (STP-2), (STP) and (SM) relays and the (MA) and (MB) magnets release, stepping the brush assembly of the master connector to terminal 1. The operation of the (SM) relay also operates the (MON) relay which lights the (MON) lamp if the (LAMP) key is operated, indicating that the master switch is being stepped off-normal.

7. GROUP SELECTOR

In position 3, the (SM) relay releases but the (MON) relay holds through the (CO) arc and inner winding of (G-1-ON) relay which operates. The (G-1-ON) relay operated, connects battery to the (G-1-ON) lamp and the (GON) relay. The (GON) relay does not receive enough current to operate. The (SG-1) and (STP-2) relays operate in position 3. With the (SG-1) relay operated, the (G-1-A) and the (G-1-B) magnets operate in parallel to ground on cam (Q-1). The (SG-1) relay operated, short-circuits the (STP) relay through the back contact of the (G-1) magnets. When the (G-1) magnets operate, the short circuit is removed and the (STP) relay operates, advancing the switch to position 4.

8. LINE FINDER SELECTOR

As the switch leaves position 3, the (STP), (STP-2) and (SG-1) relays and the (G-1-A) and the (G-1-B) magnets release, stepping the brush assemblies of the two group connectors to terminal 1. With the brush assembly of the group connectors on terminal 1, the (LF-1) and (RTS) relays operate in series with the outer winding of the (G-1-ON) relay through the (CO) brush. The (RTS) relay operated, operates the (PM) relay. The (SLF-1) and (STP-1) relays operate in series through the (P) brush to ground on the (SS-1) relay normal. Ground on cam (Q-1) through the (SLF-1) relay operated, operates the (LF-1) magnet. When the (LF-1) magnet contacts break, the (STP) relay operates, advancing the (R-1) switch to position 5. The operation of the (LF-1) relay lights the associated lamp if the (LAMP) key is operated indicating that the first line finder connector has been associated with the group switch and is off normal. As the switch leaves position 4, the (STP), (STP-1) and (SLF-1) relays and the (LF-1) magnet release. The release of the

(LF-1) magnet steps its brushes to terminal 1.

9. SETTING OF CLASS CIRCUIT

The (CL) relay operates in position 5, through cam V, (B) arc and brush of the class switch, (SR-1) relay, cam (M-3) to ground. The same ground through the (B) brushes and terminals of the (MB), (G-1-B) and (LF-1) connectors, over leads A, B, C or D, contact of the (CL) relay, and winding of the proper class relay, winding of the (N) relay to battery on the class switch operates the proper class relay and the (N) relay in series. The operation of the (N) relay opens the (RN) lead to the class selector frame, preventing the class selector from being returned to normal, prematurely. The operated class relay locks to ground on the (RN) key. The class relay operated, closes a circuit from ground through the break contact of the (DB) relays, cams (E-1) and (F-1), advancing the (R-3) switch to position 2, 5, or 8, depending upon which class relay is operated. The (DTS) relay operates in parallel with the (R-3) magnet, thus preventing the (R-1) switch from moving out of position 5 prematurely. When the (R-3) switch is set, the (DTS) relay releases. As the (R-1) switch enters position 5 the (SLF-1) and (STP-1) relays operate. With the (SLF-1) relay operated, and the (DTS) relay normal, the (LF-1) magnet operates through the contacts of the particular class relay operated to ground on the (DB-1) relay. When the selector contacts break, the (STP) relay operates, advancing the (R-1) switch to position 6. In position 2, 5 or 8 of the (R-3) switch the "first test" lamp is lighted if the (LAMP) key is operated. As the (R-1) switch advances from position 5, the (LF-1) magnet releases, moving the brush assembly to terminal 2. Terminals 2 to 21 inclusive and the (PMG) arc are grounded and operate the (PMG) relay. In position 6, the (SLF-1), (STP-1), (STP) and (CL) relays release.

10. SPARE LINE FINDER TERMINALS

The spare terminals on the (C) arc of the line finder connector are connected to lead (I). When the (C) brush makes contact with the spare terminals, the (SLFT) relay operates and locks to ground on cam N. The (SLFT) operated, operates the (DB) relay and advances the (R-1) switch to position 18. The (DB) relay operated, lights the (BLF) lamp and operates the (DB-1) and (TR) relays. The (DB-1) and (TR) relays perform no useful function at this time. In position 18, the (STP-1) and (SLF-1) relays operate in series to ground on cam J and the (SLFT) and (DB) relays release. The (DB) relay released, extinguishes the (BLF) lamp and releases the (DB-1) and (TR) relays. The (DB) relays released, operate the (LF-1) magnet, thereby moving the line finder selector to the next terminal and operating the (STP) relay. The (STP relay, advances the (R-1) switch to position 1. As the switch leaves position 18, the (SLF-1),

(STP) and (STP-1) relays release. The (ST) key operated advances the (R-1) switch to position 2, the (PMG) relay operated, advances it to position 6 from ground through the contacts of the (SS-1), (PLFS) and (PMG) relays, and cam (B). The next terminal is then tested for spare, busy or idle conditions.

11. BUSY LINE FINDER

When the (B) brush of the line finder connector finds a busy terminal, ground over lead (B) operates the (B) relay through cam (V), in position 5 1/2 indicating that the line finder is hunting for a line. When the line finder under test has actually been made busy, ground is connected to the (DB) lead, operating the (DB) relay as the (R-1) switch advances to position 6. With either the (B) or (DB) relay operated, the circuit through the (IDL) relay is opened, preventing its operation and the advancement of the (R-1) switch from position 6. The operation of the (DB) relay also operates the (DB-1) and (TR) relays and lights the (BLF) lamp. The (TR) relay operated opens the tip, ring and sleeve leads, preventing objectionable clicks in the subscriber's receiver. The (DB-1) relay performs no useful function at this time. The test circuit remains in position 6 until the busy condition is removed from the line finder or until the time alarm operates.

12. IDLE LINE FINDER

When a line finder circuit is idle, ground is not connected to the (B) or (DB) leads and the (B) and (DB) relays remain normal. The (IDL) relay operates to battery on cam (X-1). The (IDL) relay operated, connects ground to the (DB) lead making the district busy, advances the (R-1) switch to position 7, operates the (ST) register and (CT) relay. The (CT) relay operated, operates the (CT) register. Ground on the (DB) relays normal, through cams (G) and (F), (TR) relay, (S) brush of the master connector and lead (S) operated the A (ST) relay. Note - (ST), (TR) and (LF) refer to the start, trip and line finder circuits respectively. The A (ST) relay, operated operates the B (ST) relay. The B (ST) relay, operated, operates the (C), (C-1) and L (ST) and (LC) relays. The (LC) relay operated disconnect ground from (DB) lead. The L (ST) relay operated, operates the BA (TR) relay. The L (ST) and (BA) (TR) relays operated connect battery to the (H) lead. The BA (TR) and (C-1) (ST) relays operated, operate the TR (TR) relay. The TR (TR) relay operated, locks through the C (ST) relay operated, and operates the (ST-A) (ST) relay. The (ST-A) (ST) relay operated operates the D (ST) relay and connects ground to lead (Z) through the C (ST) relay operated. With the (LC) relay operated, ground on the (Z) lead is connected to the (LF) lead operating the LF (LF) relay. From this point

on the trip, start, line finder and district selector circuits function as for a regular call hunting the test line and an idle sender and releasing the trip and start circuits. When the (ST-A) (ST) relay releases, the E (ST) relay operates. The E (ST) relay operated, releases the C and (C-1) ST relays. The B, D and E (ST) relays are locked under control of the A (ST) relay which remains operated until the (R-1) advances to position 18 or the (TR) relay operates. When the test line and an idle sender are found battery and ground are connected to the ring and tip leads operating the (PC) relay. The (PC) relay operated, advances the (R-1) switch to position 8. The (EC) relay operates in position 7 from ground on the (DB) relays normal and locks under control of the (EC) and (RN) keys. The (EC) relay operated, closes an operating circuit for the (EC-1) relay when the master switch returns to normal.

13. TESTS FOR NON-START OF LINE FINDER

While in position 7, ground is connected to the (Z) lead, operating the (NLF) relay and the line finder relay in the line finder. If the operation of the line finder relay fails to start the up drive, the circuit functions as follows:- The first closure of the interrupter contacts, operates the (NLF-2) relay. The (NLF-2) relay operated, locks in series with the (NLF-3) relay which operates when the interrupter contacts break. The operation of the (NLF-3) relay in turn operates the (NLF-4) relay upon the next closure of the interrupter contacts. The (NLF-4) relay operated, locks to ground on the (DB) relay, operates the (TR) and (DB-1) relays and lights the (NLF) lamp as an indication that the line finder relay has failed to start the up-drive. The operation of the (TR) relay opens the tip, ring and sleeve terminals from the start circuit, thus holding the test circuit in position 7. The (DB-1) relay performs no useful function at this time. The circuit remains in this position as a trouble condition. If the operation of the line finder relay starts the up-drive, the (GA) relay in the start circuit operates and removes ground from the (Z) lead, thus removing the short circuit from the (NLF-1) relay, which operates in series with the (NLF) relay to ground on the (DB) relays. The (NLF-1) relay operated, removes ground from the interrupter contacts, preventing the (NLF-2), (NLF-3) and (NLF-4) relay from operating and the test proceeds.

14. TEST FOR OVERSTEP OF LINE FINDER

In position 7, with the (LC) relay operated, when the elevator reaches the (M) segment, ground is connected to the (B) lead, operating the (OS) relay. The (OS) relay operated, in turn operates the (OS-2) relay, which prevents the operation of the (OS-3) relay. When the line

finder relay releases, ground is removed from the (B) lead, removing the short-circuit from the (OS-1) relay, which operates. The (OS-1) relay operated, releases the (OS-2) relay. The release of the (OS-2) relay is very slow, sufficient time is allowed for the sender selector to hunt over 7 terminals and the test switch to be moved out of position 7 before the (OS-3) relay can be operated. Should the line finder overstep, the tip and ring leads will not be connected through to the sender and the (PC) relay will not be operated, holding the (R-1) switch in position 7 and the (OS-3) relay operates. The (PC) relay operated in a normal call releases the operated (OS) relays. The (OS-3) relay operated, lights the (OS) lamp indicating that the line finder has overstepped and operates the (TR) and (DB-1) relays. The (TR) relay opens the tip, ring and sleeve terminals of the start circuit, holding the test circuit in position 7 until the operation of the (RN) key to restore the circuit to normal. The (DB-1) relay operated performs no useful function at this time.

15. NON-OPERATE OF (F) RELAY IN LINE FINDER

As the (R-1) switch leaves position 7, the (IDL) relay releases, but the (LC) relay is held until the switch leaves position 7 1/2. During this short interval of time, ground through the (IDL) relay, (DB) and (B) relays normal, (OS) relay, (OS-1) relay normal and (LC) relay operated is connected to lead (B). With the (MB) relay in line finder operated, ground on lead (B) places a bad non-operate condition on the (F) relay (line finder circuit). Should the (F) relay operate a false pulse will be sent to the sender.

16. DIALING OF THREE DIGIT CODE

With the (R-1) switch in position 8, ground on the (DB) relays normal advances the (R-2) switch out of position 1, the (B) cam carrying it for one complete revolution. As the (R-1) switch is advancing out of position 7, the tip and ring sides of the group test line are closed through to the 100 ohm resistance in the pulse circuit over leads (A) and (B) and cam (E-2) to hold the sender. As the (R-2) switch rotates, the (E-2) cam sends pulses to the sender until it reaches position 5 1/2, when cam (J-2) and lead (M-1) shunts cam (E-2) preventing further pulses from being sent. When the dial pulse sequence switch reaches position 16 1/2, the (CK-1) relay operates and when in position 17 1/2, the (CK) relay operates and both relays lock to ground on the (DB) relays normal through cam (G-1). The (CK-1) relay operated, in turn opens the energizing circuit through the (R-2) magnet, thus preventing the (R-2) switch from making a second revolution until the (R-1) switch has advanced

to position 9. The (CK) relay operated, advances the (R-1) switch to position 9. When the (R-1) switch leaves position 8, the (CK) and (CK-1) relays release, advancing the (R-2) switch out of position 1. The second digit of the three digit code is sent during the second revolution of the (R-2) switch over leads (A) and (B), until shunted by the (M-2) lead and lead (K). As the (R-2) enters position 16 1/2 on the second revolution, the (CK-1) relay reoperates, performing the same function as just described and the (CK) relay operated, advances the (R-1) switch to position 10. In position 10, the (CK) and (CK-1) relays release. Also in position 10, the (FR) relay operates over the (DB) lead, and locked to the same ground under control of the (DB-1) relay. The (FR) relay, operated, opens the circuits for operating the (STP) relay and for advancing the (R-1) switch from position 1.

17. DIALING OF OTHER THAN THREE DIGIT CODE

When only one or two digits are required to satisfy the sender associated with the district selector circuit under test, the first digit is sent in position 8 in the same manner as the first digit of a three digit code. In position 9, ground on cam (G-1), using "Z" wiring, advances the (R-1) switch to position 10. The (R-1) switch advances to position 11 by ground through cam (F-1) using "W" wiring. When two digits are required to satisfy the sender, they are sent in positions 8 and 9 as described for the three digit code. In position 10, it is advanced by using "W" wiring and ground on cam (F-1).

18. TESTS FOR LINE CLOSURE

As the (R-1) switch advances to position 11, the (18-U) resistance remains across the tip and ring leads over leads (A) and (B) holding the (L) relay in the sender. The sender makes district brush and group selections. The first two sleeve terminals in the selected group are grounded, by the operation of the (GS) relay which operates in position 11, so that the third terminals in the group are selected. These selected terminals are connected to cams (R-1), (Q-1) and (P-1). The translation of the code used is such that the office selections are skipped and the fundamental circuit is closed for trunk test operating the (TC) relay. The (TC) relay operated, operates the (TC-2) relay which locks in series with the (TC-1) relay. When the sender advances to make talking selection the (TC) relay releases allowing the (TC-1) relay to operate in series with the (TC-2) relay. The (TC-1) relay operated, grounds the (S) lead making the trunk terminals busy. When talking selection is completed the (TC) relay reoperates. The (TC) and (TC-1) relays, operated, advances the (R-1) switch to position 12. When the switch advances from position 11, the ground to the (S) lead of the

test circuit is transferred from the make contact of the (TC-1) relay to the break contact of the (RO) relay, and the (TC), (TC-1), (TC-2) and (CS) relays release.

19. TEST OF SUPERVISORY RELAY (SC) "P" WIRING

With the switch in position 12, the 20 ohm resistance (Y) is bridged across the tip and ring for soaking the supervisory relay in the district. When the (F) contacts of the interrupter close, the (SK) relay operates and locks. When the (B) contact of the interrupter makes, the (SK-1) relay operates and locks. On the next make of the (F) contact, the (R-1) switch advances to position 13, the (A) cam carrying it to position 14. The (SK) relays release as the (R-1) switch leaves position 12. In position 14, the (SE) relay operates, and locks to ground on cam (M-3). While in position 12, the (PSK) relay operates from ground on cam (N-1), and battery on the (SR-2) relay. The (PSK) relay, operated, connects battery and ground through the (SK) resistance to the tip and ring sides of the test line to operate the (CB) relay in the district circuit. The polarized (CS) relay in the district circuit operates and advances the district to the "talking to operator" position. When the switch leaves position 12, the (PSK) relay releases and in position 14, the (CS) relay operates through the resistance as specified by the Telephone Company, through the (PSK) and (BB) relays normal, over the ring side of the district selector circuit through the master switches, (TR) relay, cams (M-1) and (O-1) contacts of the (REL) relay, (Y) resistance (20 ohms), cams (K-1) and (K-3) to ground. The (CS) relay operated, operates the (I) relay over the tip side of the line. The (I) relay locks through its make contact and operates the (RO) relay, when the (IV) contacts of the interrupter make. The (RO) relay operated, locks and opens the sleeve circuit through cam (P) allowing the district to advance from its "talking to operator" position which releases the (CS) relay in the test circuit. The (CS) relay released, releases the (I) relay. The (RO) relay operated and the (I) relay released advances the (R-1) switch to position 15. If the district circuit has failed to advance to the "talking to operator" position, the (CS), (I) and (RO) relays fail to operate and block the (R-1) switch in position 14.

20. TEST OF SUPERVISORY RELAY (DC) "P" WIRING

As the test switch passes from position 14 to 15, the 20 ohm soaking circuit is held across the tip and ring sides of the test circuit, soaking the supervisory relay (DC). With the switch in position 15, the (SK) and (SK-1) relays reoperate under control of interrupter contacts (F) and (B). The operation of the (SK-1) relay removes the short circuit

from around the (S), (U), (V), (W) and (X) resistances and the (REL-1) relay bridging them in series with the (Y) resistance across the tip and ring sides of the group test line, thereby releasing the supervisory (DC) relay in the district circuit. The (REL-1) relay operates over this circuit as soon as the district releases the line so that 48 volts is connected through the line relay to the (R) lead and advances the (R-1) switch to position 16. The (REL-1) relay is given special adjustment to take care of an inductive kick from the repeat coil. The (SK), (SK-1) and (REL-1) relays release as the switch advances to position 16. With the (R-1) switch in position 16, the (R-2) switch advances to the next position from ground on cam (H-1). With the (R-2) switch in position 3, 6 or 9, ground on cam (Y-1) through cam (G-3) advances the (R-1) switch to position 17. Ground on the (SR-2) relay normal advances the (R-1) switch to position 18. With the (R-3) switch in position 3, the (SR-3) relay operates through the contacts of the (SR-2) relay, (SR) and (MR-3) relays, (REP) key, cam (F-3) and (ST) relays to ground on cam (I-1). The operation of the (SR-3) relay advances the (R-1) switch to position 1, and connects ground to the (SR-2) relay, causing it to operate and lock in series with the (SR-3) relay as the (R-1) switch advances from position 18.
Note: For Q wiring see paragraph 5D.

21. FALSE REVOLUTION OF DISTRICT

Should the (CS) relay in the district fail to release the district sequence switch will rotate until the (CS) relay releases. Under such a condition ground will be removed from the (DB) lead in positions 13 1/4 to 1 1/2 of the district switch. The (FR) relays are slow release relays and are used to cover this condition, but they are not slow enough hence under extreme conditions the test circuit will not test for a rotating district. Should the (FR) relays hold under this condition, the (R-1) switch will remain in position 1 until the district stops rotating or it will give a trouble alarm. If the district under test is restored to normal, the (FR) relays release, advancing the (R-1) switch to position 2 of its second revolution.

SECOND TEST OF DISTRICT CIRCUIT - REPEATING COIL IN

22. SECOND REVOLUTION

With the (R-1) switch in position 2 (second revolution) ground on the (SS-1) relay through the contacts of the (PLFS), (PMG) and (DTS) relays through cam (B) advances the switch to position 6. The switch functions in positions 6 to 10 inclusive in the same manner as described for the first revolution of the switch, with the exception that the digit code sent is such that it will stop the district circuit in a talking position.

In position 11, the (18-U) resistance is bridged across the tip and ring holding the sender, and the (TC) relay operates during trunk test by the sender. The party test is now made by the district (first party normal line). When the district is advanced to a talking position the (TC) relay reoperates and the (DC) relay in the district is operated. The (GS), (TC), (TC-1) and (TC-2) relays function as described in paragraph 18 to advance the (R-1) switch to position 12. With the (R-1) switch in position 12, the (DC) relay in the district is given a soaking current, the (Y) resistance being connected across the tip and ring of the group test line. Also the (CS) relays in both the test and district circuits are operated. The (CS) district relay, operated, charges the call. The (CS) relay is held operated and in position 14 operates the (O) relay. The (SK), (SK-1) and (SK-2) relays operate, under control of the (F) and (B), contacts of the interrupter, and advance the (R-1) switch to position 13, the (A) cam advances it to position 14. As the (R-1) switch enters position 13, ground on cam (Y-1) operates the (REL) relay which locks to ground through cam (F-1), and removes the shunt around the (X), (W), (V), (U) and (S) resistances and (REL-1) relay, the (REL-1) relay does not operate. The (DC) relay in the district circuit releases due to the high resistance connected in series with the (REL-1) relay but the district is not immediately released being held by the (D) relay in the district. The (O) relay operated in position 14, locks and connects ground to the (I) relay which operates when the interrupter contacts make. The operation of the (O) relay also shunts the (REL-1) relay or (Z) resistance and the (S), (U), (V), (W) and a portion of the (X) resistance, allowing the supervisory (DC) relay in the district to operate over a condition which simulates a short loop. The interval of time between the release of the (DC) relay in the district in position 13 of the (R-1) switch and the reoperation in position 14 is such that the district circuit is not released, due to the slow release of the (D) relay. The (I) relay locks and operates the (RO) relay. The (RO) relay operated locks and operates the (SO) relay. When the (IV) contact of the interrupter makes, it advances the test switch to position 15. The (SO) relay operated, advances the (R-1) switch to position 16. With the switch in position 16, ground on cam (Y-1), advances the switch to position 17. The tip and ring of the group line is opened as the switch advances from position 15, releasing the (DC) relay in the district allowing the district to advance to the message register or coin collect position or return to normal.

23. FLAT RATE

When testing flat rate district circuit the (FL) relay operates in position 5 of the first revolution of the (R-1) switch. The (FL) relay operated sets the (R-3) switch in position 8. The (R-3) switch is moved to position 9 when the (R-1) switch is in position 16 of the 1st revolution. The circuit functions as has previously been described up to

position 17 of the (R-1) switch (2nd revolution). The (R-1) switch is advanced to position 18 by ground on cam (K-3). As the (R-1) switch leaves position 17, the (RO), (SO), (O), (REL) and (I) relays release.

24. ADVANCE TO NEXT DISTRICT

The (SR-1) relay now (position 18) operates from ground on cam (I-1). The (SR-1) relay operated, advances the (R-3) switch to position 10 when the (SR), (SR-1), (SR-2) and (SR-3) relays release. The (SLF-1) and (STP-1) relays operate in position 18. The (FL) relay operated (see paragraphs 23 and 9) advances the (R-3) switch to position 17. With the (R-3) switch in position 17, the (SLF-1) relay operated and the (FR) relay normal (the district having returned to normal, the (LF-1) magnet operates. The operation of the (LF-1) magnet allows the (STP) relay to operate, which advances the (R-1) switch to position 1. When the (R-1) switch advances from position 18, the (SLF-1), (STP) and (STP-1) relays release and the (LF-1) magnet releases stepping the (LF) selector to the next terminals. The circuit is now ready to test the next district.

25. MESSAGE REGISTER ONE-PARTY

The (MR-1) relay operates and locks in position 5 of the (R-1) switch, and when the (LF) selector rests on terminal 1. The (MR-1) relay operated advances the (R-3) switch to position 2. The circuit functions as described in paragraphs 11 to 22 inclusive advancing the (R-1) switch to position 17 of the 2nd revolution. At this time the district has advanced to the register position and connects battery to the (MZ) lead (the call having been charged) which operates the (R) relay. This battery is connected through three (18-AN) resistances in parallel in the district, if one or two of these resistances are open the (R) relay will not operate, if these resistances are short-circuited the (BX) relay operates as well as the (R) relay. The (R) relay operated, operates the (WD-1) relay, in turn operates the (WD) relay. The (WD) relay operated locks and the (WD-1) relay releases as soon as the district advances disconnecting battery from the (MZ) lead. The (R-1) switch is advanced to position 17 from ground on the (BX) relay normal through the (WD-1) relay normal and (WD) relay, operated. Should the (BX) relay operate, or should the (R) relay not operate, the (R-1) switch will be held in position 17 as a trouble condition. When the (R-1) switch leaves position 17, the (RO), (SO), (O), (REL) and (I) relays release. The circuit functions in position 18 as described in paragraph 24.

26. MESSAGE REGISTER TWO-PARTY

When testing two-party message register district the (MR-2) relay operates in position 5 of the (R-1) switch and with the (LF) selector

resting on terminal 1. The (MR-2) relay operated locks and advances the (R-3) relay to position 2. When the (SR-2) relay operates as the (R-1) switch starts on its second revolution, it operates the (MR-3) relay. The (MR-3) relay operated, operates the (MR-4) relay instead of the (SR-1) relay as the (R-1) switch advances to position 18 of the second revolution. The (MR-4) relay, operated, advances the (R-1) switch to position 1, in turn operating the (MR-5) relay. The (MR-4) and (MR-5) relays operated lock to cam (M-3). Otherwise the circuit functions as described in paragraphs 11 to 22 inclusive and 25.

27. THIRD REVOLUTION

The (R-1) switch is required to make a third revolution and the class switch does not change positions. If the district circuit has not been seized by another line finder when returning to normal, the ground is removed from the (DB) lead, releasing the (FR) relays thus advancing the (R-1) switch to position 2. In positions 1 to 16 of the third revolution are passed through in a similar manner to the corresponding positions in the second revolution, the same digit code being sent by the (R-2) switch in this revolution as in the previous one. When the test switch advances to position 11 on its third revolution it waits until the district makes party test. The district selector circuit before making party test, connects battery to the tip side of the group test line, and operating the (PT) relay to ground on cam (M-3). The (PT) relay operated, opens the circuit for advancing the (R-1) switch from position 18 and operates and locks the (PT-1) relay. The (PT-1) relay operated, disconnects ground through 1000 ohms to the (T) lead to the district and connects it to 24 volts battery through the (GS) relay operated. When message register current is again connected to the test line in position 17, the (R) relay operates, in turn operating the (WD-1) and (WD) relays which advance the switch to position 18. In position 18 of the third revolution, the (SR-1) relay operates and locks, advancing the (R-3) switch to position 10 or next normal position. As the (R-3) switch returns to normal all the (PT) and (SR) relays release in turn releasing the (MR) relays. The (R-3) switch is reset, the (LF) connector is advanced one step and the (R-1) switch is advanced to position 1, in a manner similar to that described in paragraph 24.

28. CLASS SELECTOR

Each time the (R-2) switch advances to position 2, 5 or 8, the circuit is closed through the winding of the (CL) stepping magnet and cam (A-3) to ground on cam (Y-1) in position 5, energizing the magnet. When the (R-1) switch leaves position 5, the (CL) magnet releases, stepping the brush assembly of the selector switch to the next terminal,

extinguishing the previous lamp and lighting the successive lamps 1, 2 or 3 etc. under control of the (LAMP) key. The lighted lamp indicates which district selector is being tested. As the class switch brush assembly steps from terminal to terminal, lamps 1 to 20 will light indicating the progress of the test. Thus the class selector follows the movement of the line finder connector and is able to change its setting when stepped from terminal 21 and when the next line finder connector is used. When the brush assembly of the class selector switch reaches terminal 22, the holding circuit through the operated class relay and (N) relay is opened, releasing the relays. The (R-3) switch is returned to normal with the (R-1) switch in position 1 to 17, and the (DB) or (DB-1) and class relays normal.

29. STEP GROUP CONNECTOR SWITCH

In order to test the district selector associated with another line finder connector switch, it is necessary to step the brush assembly of the group connector one terminal. When the line finder connector just used, leaves terminal 21, the (MG) relay releases and the (R-1) switch is advanced to position 2 when the (FR) relays release. The (PM) relay operated, advances the (R-1) switch to position 3. The group selector is advanced, another line finder selector being seized and advanced, the class relays are set and another test is started as described in paragraphs 7 to 10 inclusive.

30. STEP MASTER CONNECTOR SWITCH

After the 400 district selector circuits associated with a terminal of the master connector switch have been tested, the brush assembly of the group connector switch being released, steps off terminal 21, and the associated (RTS) relay releases, in turn releasing the (PM) relay. The (PM) relay released, operates the (SM) and (STP-2) relays in position 2 of the (R-1) switch. The (SM) relay operated, operates the (MA) and (MB) magnets. When the (MA) and (MB) magnets operate, the (STP) relay operates. The operation of the (STP) relay advances the (R-1) switch to position 3, and in so doing, releases the (MB) and (MA) magnets, moving the brush assemblies of the master switch to the next terminal. From this point on, the test proceeds in the same manner as with the group connector associated with the first terminal.

31. CONCLUSION OF A ROUTINE TEST

As explained in paragraph 12, the (EC) relay operates when the (R-1) switch enters position 7 at the beginning of a routine test. When all the district selector circuits have been tested by this circuit, the

master connector switch steps from terminal 21 to normal, operating the (EC-1) and (SM) relays. The (EC-1) relay operated, operates the (SLFT) and (FR) relays, lights the (EC) lamp and opens the operating circuits of the (MB) and (MA) stepping magnets. The (SLFT) relay locks through cam (N-1), advancing the (R-1) switch to position 18 and operates (DB) relay in turn the (DB-1) and (TR) relays. The operation of the (DB) relays removes ground from cams (F) and (G), preventing the relays under control of these cams from operating. The (DB), (DB-1), (TR) and (SLFT) relays release as the switch advances from position 17. The (R-1) switch is advanced to position 1 by the (RTS) relays normal. The (FR) relay operated prevents the (R-1) switch from advancing out of position 1. If another cycle of test is not desired, the (RN) key is operated and the (ST) key released. The operation of the (RN) key releases all operated relays lock through the break contacts of the (RN) key. The (EC) relay released, releases the (SM) and (EC-1) relays, in turn the (FR) relay, restoring the circuit to normal.

32. RETURN TO NORMAL (RN) KEY

When it is desired to restore the test circuit to normal from any position, the (RN) key is operated. The (RN) key, operated, (a) releases the (TA) relay, if operated, returning the time measure switch to normal, (b) releases the class relays, (c) opens the circuit to the (GON) relays, (d) operates the (DB) relay in turn the (DB-1) and (TR) relays which function as described in paragraph 31, (e) advances the (R-1) switch to position 1 and (f) resets the master, group and line finder selectors. The (DB), (DB-1) and (TR) relays release as the (R-1) leaves position 17. With the (R-1) switch in position 1, and the (DB) and class relays normal, the (R-3) switch is advanced to the next normal position. With the (R-1) switch in position 1, the (SM) relay (if the master switches are off normal) operates in series with the (STP-1) relay through the (MON) relay operated. The (SM) and (STP-1) relays operated, the master selector magnets operate allowing the (STP) relay to operate. The (STP) relay operated operates the (RM) relay. The operation of the (RN) relay releases the selector magnets allowing the brush assembly to step one terminal. When the magnets release they short-circuit the (STP) relay, releasing the (RN) relay. The (RN) relay released, permits the (SM), (STP-1) relays and the selector magnets to function stepping the brush assembly one more step. This magnet continues to operate and release stepping the master selector to normal at which time the (MON) relay releases. The (MON) relay, normal, transfers the circuit from the (SM) relay to a (SG) relay where the circuit functions as has just been described stepping any off normal group

selector to normal. When the group selectors are all normal the operated (G-1-ON) (RTS) and (LF) relays release. With the (LF) relays normal any (LF) selector that is off normal will be returned to normal.

33. SPARE TERMINAL ON MASTER AND GROUP SWITCH

When the master switch steps to a spare terminal, the (R-1) switch being in position 3, the (SPT) relay operates. The (SPT) relay operated, opens the lead for advancing the (R-1) switch until all spare terminals have been passed and operates the (SPT-1) relay, as soon as the (STP) relay operates as described in paragraphs 6 and 7. The (SPT-1) relay opens the ground lead to the master magnet, allowing the master magnet to release and step the brushes to the next terminal. As the magnets release the (STP) relay releases in turn releasing the (SPT-1) relay. The cycle is repeated until a working terminal is found. When the group selector steps to a spare terminal the (R-1) switch has advanced to position 4 and the selector is stepped to the next working terminal as just described for the master selector.

34. TIME MEASURE FEATURE

As stated in paragraph 5, the operation of the (ST) key operates the (TA) relay which locks to ground on cam (N-1). Should trouble develop either in the test circuit or in the district circuit under test or should sufficient time not be left after the return of the district circuit to permit the completion of a test, the time alarm circuit operates, lighting the lamps and operating the (ALM) register. Ground through the 152 interrupter, and the (STP) arc operates the (TA) magnet. When the interrupter contacts break, the (TA) magnet releases stepping the brush assembly of the (TM) switch to the next terminal. This cycle is repeated until the brushes rest on terminal 16. If this occurs before the (R-1) switch has passed position 18 on its second or third revolution through the make contact of the (TA) relay, operates the (ALM) register and lights the lamp. The brushes remain on terminal 16 until the operation of the (TA) key. The operation of the key releases the (TA) relay which steps the (TM) switch to normal.

35. SEPARATE BUSY TIME ALARM AND TROUBLE ALARM

When figure 2 is specified, the operation of the (ST) key operates the (BY) relay, which locks over lead (B). The operation of the (BY) relay connects the (200-R) selector magnet to ground through the 152 type interrupter. As the interrupter contacts make and break, the selector magnet follows, stepping the brush assembly of the (BY) switch.

when the (AL brush encounters terminal 16, the circuit is closed from ground on the (BY) relay to the (BY) lamp which lights, indicating that a busy district selector circuit has been encountered. The circuit remains in this position until the operation of the (TA) key, which operates the (HA) relay. The (HA) relay locks through cam (N-1) and releases the (BY) relay, the latter relay stepping the brush assembly of the (BY) switch to normal. Should trouble develop in the test circuit or be encountered in the district circuit under test, it is advisable to decrease the time before the alarm is operated. The operation of the (IDL) relay as described under paragraph 12, operates the (TBL) relay which locks to cam (N-1). The (TBL) relay operated, connects the 152 type interrupter through the (STP) arc of the (TBL) switch to the (TBL) magnet, causing it to operate and release in sequency with the interrupter. The operation and release of the magnet, moves the brush assembly of the (TBL) switch to terminal 3 or 4 as determined by the wiring used. When the brush assembly of the switch has stepped to the third or fourth terminal, the (TBL) lamp lights and the (TBL) register operates. The circuit remains in this position until the operation of the (TA) key which performs the same function as described in the first of the paragraph 34. When no trouble is encountered, the circuit is opened through cam (N-1) in position 18 of the (R-1) switch, releasing the (TBL) relay. The (TBL) relay released steps the selector to the next normal terminal.

36. END OF CYCLE (EC) KEY

When the master connector has stepped from terminal 21 to normal, the (SM) and (EC-1) relays operate in series and function as described under paragraph 31. When the second cycle of routine test is desired, the (EC) key is operated, releasing the (EC) relay which in turn releases the (EC-1) relay and (SM) relay. The (EC-1) relay releases the (FR) relay, allowing the (R-1) switch to advance to position 2, starting the second cycle of routine test.

37. CONTROL ADVANCE (CA) KEY

If trouble develops in the test circuit or in the district selector circuit under test after position 5 of the test switch, the time alarm lights as described under "Timing Features". If after the (TA) key is operated, the circuit does not continue to function, the (CA) key is operated. The operation of the (CA) key operates the (DB) relay, advances the (R-1) switch to position 18 opens the circuit for advancing the (R-1) switch out of position 1 and opens the circuit for operating (LF) magnet. The (DB) relay operated, lights the (LF) lamp and operates the (DB-1) and (TR) relays. The (DB-1) relay, operated, releases the (FR) relay. The (TR) relay, operated, opens the (T), (R), and (S) leads

releasing the district and start circuit. The (R-1) switch will advance to position 1 if the trouble occurred in the first revolution and awaits the release of the (CA) key. Otherwise the (R-1) switch remains in position 18 until the release of the (CA) keys. When the (CA) key is released the routine testing proceeds in the usual manner.

38. PORTABLE KEYS

(32-A Test Set). When trouble occurs before position 6 of a first revolution of the test switch, it is due to lack of synchronism between the (MA) and (MB) master connectors, or the (GA) and (GB) group connectors. Trouble of this sort cannot be corrected by the operation of the (CA) key. The portable key is inserted in the jack associated with the connector switch which is out of synchronism. The operation of the white button steps the (A) selector, the operation of the red button steps the (B) selector. The proper button is operated and the selectors are stepped into phase with one another. The portable key is then withdrawn from the jack associated with the connector switch and the test continues in the usual manner.

39. TWO GROUP SELECTORS OFF NORMAL

Should two group switches step off normal or get off normal at the same time, battery through the 600 ohm resistance in parallel associated with each group connector, operates the (GON) relay. The (GON) relay does not operate in series with one 600 ohm resistance. The (GON) relay operated, lights the (GON) lamp, and operates the (GON-1) relay. The (GON-1) relay operated, (a) locks, (b) advances the (R-1) switch to position 1, (c) prevents the switch from advancing out of position 1, (d) releases the (GON) relay and lights the (GON) lamp. To continue the test, the (RN) key is operated, restoring the apparatus to normal. If it is not desired to repeat the routine test up to the point where trouble was encountered, the number of the first district circuit is dialed with the (PC) key operated. When the line finder connector steps to the proper terminals, the circuit proceeds to test the district as described under "Particular Circuit". With the release of the (PC) key, the test continues to function and test the remaining district selectors on a routine test basis.

FALSE CHARGE TESTS

40. MESSAGE REGISTER ONE-PARTY

The district circuit is tested for a no charge call by operating the (FCH) key. The circuit functions the same as described for charged

calls with the following exceptions. When the (R-1) switch enters position 14 of the second revolution the (O) relay operates (see paragraph 22) in turn operating the (BB) and (BB-1) relays through the (FCH) key operated. The (BB-1) relay operated holds the (R-1) switch in position 14 longer than for a charged call under control of the (W) and (Z) relays. The (O) relay operated operates the (I) relay. The (I) relay, operated, operates the (W) relay under control of the (A) interrupter. When the interrupter contacts break, the (Z) relay operates. The next closure of the interrupter releases the (W) relay in turn operating the (RO) relay. When the interrupter contacts break the (Z) relay releases. The next closure and break of the interrupter operates the (W) and (Z) relays. The (SO) relay now operates under control of the (B) interrupter. With the (I), (RO) and (SO) relays operated the (R-1) switch is advanced to position 15, when interrupter contacts are closed. The (SO) relay operated advances the switch to position 16, and ground on cam (Y-1) advances it to position 17. During the time the (R-1) switch is held in position 14, the (BB) relay operated, operates the (DR) relay, holds the (CS) relay operated and connects battery through 1000 ohms resistance to (R-3) lead. The (DR) relay operated transfers the (T-3) lead from direct ground to interrupted ground thus testing the (CS) relay in the district. The (CS) relay in the district follows the pulses of the interrupter (if it is properly adjusted) and the time interval is not sufficient to charge the call. The (DR) relay, operated, also transfers the (MZ) lead from the (R) relay to the (MX) relay. When the (R-1) switch leaves position 15 the (T) and (R) leads are opened releasing the district circuit. When the district circuit returns to normal ground is removed from the (DB) lead releasing the (DR) relay. The (DR) relay released, advances the (R-1) switch to position 18. The (O) relay releases as the switch advances from position 17, in turn releasing the (BB), (BB-1) and (Z) and (W) relays, if operated.

41. FALSE CHARGE

Should the (CS) relay in the district fail to release, the call will be charged and consequently the district will stop in the message register position and register the call. Under such conditions the (MX) relay operates in position 17 over the (MZ) lead. The (MX) relay, operated, operates the (FCH) relay. When battery is removed from the (MZ) lead due to the district advancing the (MX) relay, releases allowing the (FCH-1) relay to operate and lock in series with the (FCH) relay. The (FCH) relays operated, open the circuit for advancing the (R-1) switch from position 17, light the (FCH) lamp and operate the (TR) and (DB-1) relays. The (DB-1) relay releases the (FR), and (DR) relays. The (TR) opens the (T), (R), and (S) leads releasing the associated line. The test switch remains in position 17 as a trouble condition.

42. FALSE GROUND TWO-PARTY

During the third revolution (see paragraphs 26 and 27) with the (FCH) key operated, a test is made to determine whether the two-party district recognize a false ground on the tip side and prevent the district charging a call on either register. When the test switch arrives in position 11 and the (PT) relay is connected to the tip which causes the district circuit in the district selector test circuit to be stepped for charging over the (M-2) lead. The district is held for a sufficient time to set up a charge condition and when the test switch arrives in position 17, the district circuit under test will be in position 16 and the (PT) relay is again operated over the tip which should cause the (T) relay in the district circuit to operate. The (T) relay in the district circuit would cause the operation of the (I) relay, preventing the party selector from stepping until the relay is released. The test and district circuits are held until the (FG) and (FG-1) relays operate. The (INT) relay operates in position 14 of the third revolution of the (R-1) switch under control of the (O) relay. These relays are held operated until the switch leaves position 17. When the (PT) relay operates in position 17, the (FG) and (FG-1) relays operated under control of the (C) interrupter. The (FG) relay locks under control of the (INT) relay and the (FG-1) relay locks to cam (H-1). The (FG-1) relay, operated, opens the (T) lead to the (PT) relay, releasing it and the (T) and (I) relays in the district, and short-circuits the (INT) relay releasing it. The party test switch in the district now advances and sends out register current over the (M-2) lead, operating the (R) relay and moving the test switch in the regular manner. When the (INT) relay is operated, it connects the (MX) relay to the (M-2) lead and also closes a circuit from the (MX) armature to the (FCH) relay. Should the district not recognize the false ground and register a call over the (M-2) lead, the (MX) relay operates. The (MX) relay, operated, operates the (FCH) relays which function as described in paragraph 41. In the case that the district under test does not recognize the false ground on the tip side of the circuit in position 11, and fails to set the district for charging over the (M-2) lead, and for the same reason did not recognize it for retest, the charging current is sent out over the (MZ) lead. The (MZ) lead being open at the (MR-5) relay, no relay is operated, thus the test switch is stopped in position 17.

43. COIN DISTRICT

On coin district, the current to the (CS) relay in the district is interrupted in the same manner as for the message register district, but in this case, the (CR) relay is added to operate on making coin

return test and moves the test switch out of position 17 in the usual manner when the (CS) relay district has functioned properly. The (CN) and (CB) relays are connected in multiple when the (FCH) key is operated, and should the (CS) relay stick, the charge relays in the district operate, causing the sender to send positive coin current which operates the (CN) relay in turn causing the (FCH) and (FCH-1) relays to operate. The (FCH-1) relay operated, performs the same function as described in the paragraph 41.

44. TEST PARTICULAR DISTRICT

To test a particular district, the (PC) and (ST) keys are operated in the order named. The (ST) key operated advances the (R-1) switch to position 2. The (PC) key, operated, (a) opens the regular circuits for advancing the (R-1) switch out of position 2, 3, 4 and 5 and for operating the selector magnets, (b) provides a circuit for operating the selector magnets under control of the dial, (c) operates the (PUL) and (PLFS) relays and steps the class selector switch in unison with (LF) selector. In position 2 the (SM) relay operates and the dial is operated. The operation of the dial releases and reoperates the (PUL) relay which in turn operates and releases the master selector magnet thus stepping the selector around to the desired terminal. The (STP) key is now operated operating the (SS) relay, when the (STP) key is released the (SS-1) relay operates and locks in series with the (SS) relay. The (SS-1) relay operated, advances the (R-1) switch to position 3. As the (R-1) switch leaves position 2 the (SS) relays release. The (PLFS) relay operated closes a circuit for operating the (SG) or (SLF) relays in positions 3, 4 and 5 of the (R-1) switch and also opens the operating circuit for the (SLFT) relay. The (SG) relay, corresponding to the selected master selector terminal, operates in position 3. The group selector is stepped to the desired group by the operation of the dial and (R-1) switch is advanced to position 4 by the operation of the (STP) key. In position 4 the (LF) selector is advanced one step for class setting. The (STP) key is again operated, advancing the (R-1) switch to position 5. In position 5, the (LF) selector is stepped around to the desired district by the operation of the dial. At the same time the (STEP CL) selector is stepped around so that it will keep in step with the particular (LF) selector. The (R-1) switch is advanced to position 6 by the operation of the (STP) key. Otherwise the circuit functions in the usual manner as has been described. If it is desired to continue the routine test from this particular circuit on the (PC) key (after the (R-1) switch leaves position 5) is returned to normal otherwise the circuit returns to position 18 and awaits the testman. When a spare terminal is selected, the (R-1) switch may be returned to position 18 by the operation of the (CA) key.

45. REPEAT KEY (REP) FIRST TEST

When it is desired to repeat the test upon a certain district selector circuit, one of the repeat keys is operated depending upon which revolution it is desired to repeat the test. The operation of the "REP" First Test" key, (a) opens the circuit through the (R-3) switch, preventing the class circuit from advancing to next position, (b) opens the circuit through the stepping magnet of the line finder connector, preventing the line finder brush, from stepping to the next terminal, (c) opens the circuit for stepping the class selector, (d) closes circuits for advancing the (R-1) switch from positions 16 and 18, and (e) opens the circuit through the (CT) relay preventing its reoperation on the repeat test. Otherwise the circuit functions in the usual manner testing the circuit repeatedly as described for the first revolution of the (R-1) switch.

46. REPEAT KEY SECOND TEST

The operation of the "REP" Second Test" key, (a) prevents the stepping magnet associated with the line finder connector from operating and moving the brush assembly of this connector to the next terminal as in the second revolution of a regular test, (b) closes a circuit for advancing the (R-1) switch from position 18 and (c) prevents the (R-3) switch from advancing by opening the operating circuit of the (SR-1) relay. Ground on the (ST) key advances the switch to position 2 from which point the repeat test of the second revolution is performed in a manner similar to the regular test in the second revolution. The test circuit continues to repeat the test until the key is released.

47. REPEAT KEY THIRD TEST

The operation of the "REP" Third Test" key, (a) closes a circuit to advance the (R-1) switch from position 18, (b) opens the circuit through the stepping magnet associated with the line finder connector, preventing its operation and (c) prevents the (R-3) switch from being advanced by opening the operating circuit of the (SR-1) relay. The third revolution test is repeated in the usual manner. When the operated (REP) key is released the circuit continues making routine tests.

48. STOP AUTOMATIC TEST

The release of the (ST) key advances the (R-1) switch to normal, stepping the automatic test of the district circuit and prevents the (R-1) switch from advancing out of position 1. If it is desired to restore the test circuit to normal after the release of the (ST) key,

the (RN) key is operated. When a particular circuit test is being made to stop the test, the (ST) and (PC) keys are released, and the (RN) key operated.

49. PASS BUSY (PB) KEY

When it is desired to pass by all busy district, the (PB) key is operated. The test circuit may also be released when held by a busy district by the operation of the (PB) key. When the (LF) selector steps to terminals connected to a busy district the (DB) relays operate (see paragraph 11). The (DB), (DB-1) and (TR) relays operated, lock when the (PB) key is operated, until the (R-1) switch advances from position 17. With the (DB) relays and the (PB) key operated, (a) the (BSY) register operates registering the number of busy districts passed, (b) advances the (R-1) switch to position 18 and (c) in position 18 advances the (LF) selector one terminal as described in paragraph 24, the (FR) relay being released by the operation of the (DB-1) relay, and the (R-3) switch remains in the 2, 5 or 8 position as the case may be. The (R-1) switch is advanced to position 1 as described in paragraph 24 and the circuit tests another district. Should the district under test be allotted and made busy by a calling subscriber between the 1st and 2nd or 2nd and 3rd revolutions of the (R-1) switch, the (DB) relays are operated in position 6 of the (R-1) switch. The (DB) relays and the (PB) key operated, perform the functions as just described and also operate the (SR-1) relay. The circuit then functions as described in paragraph 24. Should the line finder over step, or fail to start, or should the district make a false charge, the (OS), (NLF), or (FCH) relays function operating the (DB), (DB-1) and (TR) relays. The (DB), (DB-1) and (TR) relays operated lock until the switch advances to position 18. The (DB-1) relay advances the (R-1) switch to position 18. This circuit then functions as has just been described advancing the (LF) selector to test another district disregarding any of the trouble condition, over stepping or failure to start of the line finder, or a false charge by the district. When the (OS) relays are operated, they are released as the (R-1) switch leaves position 7. When the (NLF) or (FCH) relays are operated, they release as soon as the (DB) relays operate. The repeat keys should not be operated while the (PB) key is operated.

50. TEST OF SUPERVISORY RELAYS Q WIRING

With the (R-1) switch in position 12 of the first revolution, the circuit functions as described in paragraph 19 with the following exception. The (SK-1) relay operated, operates the (SK-2) relay instead

of advancing the (R-1) switch to position 13. The (SK-2) relay, operated, advances the (R-1) switch to position 13. In position 15 the (SK), (SK-1) and (SK-2) relays, operate and lock. The (SK-1) relay operated removes the short circuit from around the (S), (U), (V), (W), (X) and (Z) resistances, thus increasing the resistance across the (T) and (R) leads so as to release the supervisory (DC) relay in the district circuit. The (SK-2) relay, operated, replaces the (Z) resistance by the (REL-1) relay. There is an interval of time between the operation of the (SK-1) and (SK-2) relays so that the inductive surge from the repeat coils in the district will be absorbed before the (REL-1) relay operates when the district releases the test line. Otherwise, the circuit functions as described in paragraph 20.